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FOREST PEST LEAFLET 29

Oak Wilt

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Oak wilt is now one of the most serious forest diseases in this country. Caused by an aggressive tree-killing fungus, *Ceratocystis fagacearum* (Bretz) Hunt, the disease is a threat to the oak resources in the 21 States where it is known to occur (fig. 1).

Hosts

No species of oak is known to be immune to oak wilt. Natural infections have been found in 16 native oak species, including most of those of commercial importance. Plantation-grown Chinese chestnut has also been found to be naturally infected. Inoculation experiments have shown that more than 35 other native and exotic oaks, American and European chestnut, two species of chinquapin, California tanbark oak, and several varieties of apple are also susceptible.

Symptoms

Symptoms of oak wilt in the red oak group differ considerably from those in the white oak group. In the red oak group, early

symptoms are wilting, bronzing, and shedding of foliage at the ends of branches in the upper crown. These symptoms quickly appear throughout the crown—often within a few weeks.

Wilting leaves typically tend to curl around the midrib, whereas leaves on trees killed by drought, lightning, and other causes have an overall crinkled appearance. The bronzing of leaves begins at the tip and outer edges of the leaf blade and spreads to the midrib and base. The line between bronze tissue and green tissue in individual leaves is very distinct (fig. 2).

Heavy defoliation accompanies leaf discoloration and wilting, and leaves will fall in all stages of discoloration; entirely green leaves may also fall (fig. 3). Dark longitudinal streaks often occur in the sapwood of infected trees, but are not always present and may occasionally be found in uninfected oaks. Sprouts frequently grow from the bole and larger branches after defoliation of the original crown. Most trees die within a year after infection, and some, even large ones, may be dead within 1 or 2 months after the onset of symptoms.

Leaf fall during the growing season, together with typical dis-

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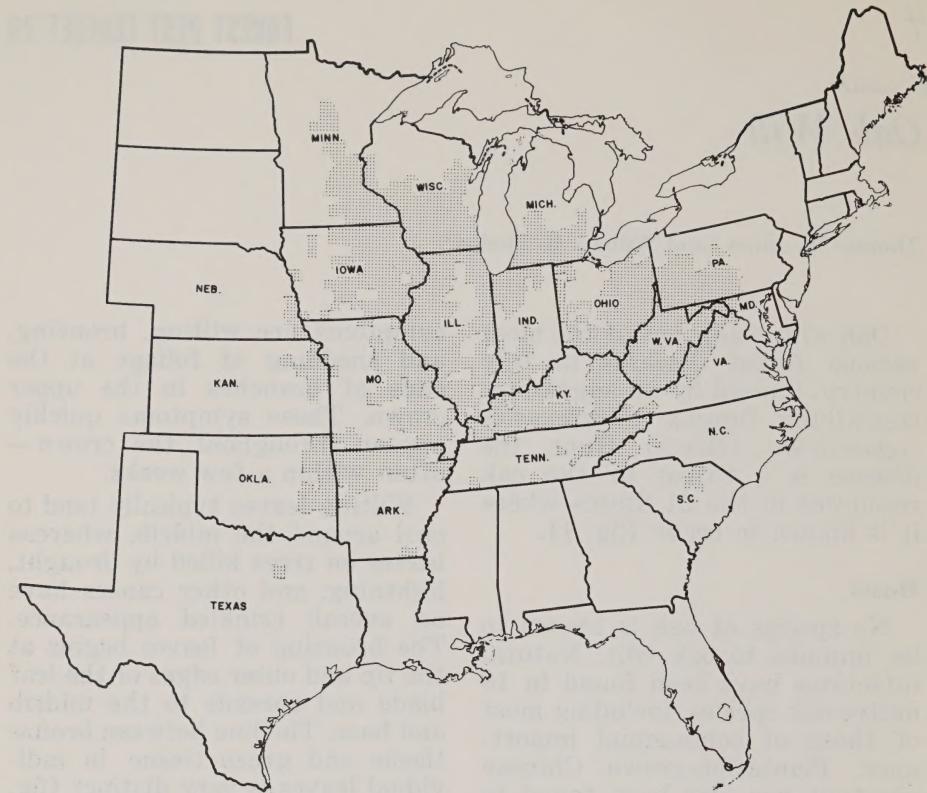
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KNOWN DISTRIBUTION OF OAK WILT

1970



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Figure 1.—Known distribution of oak wilt, 1970.



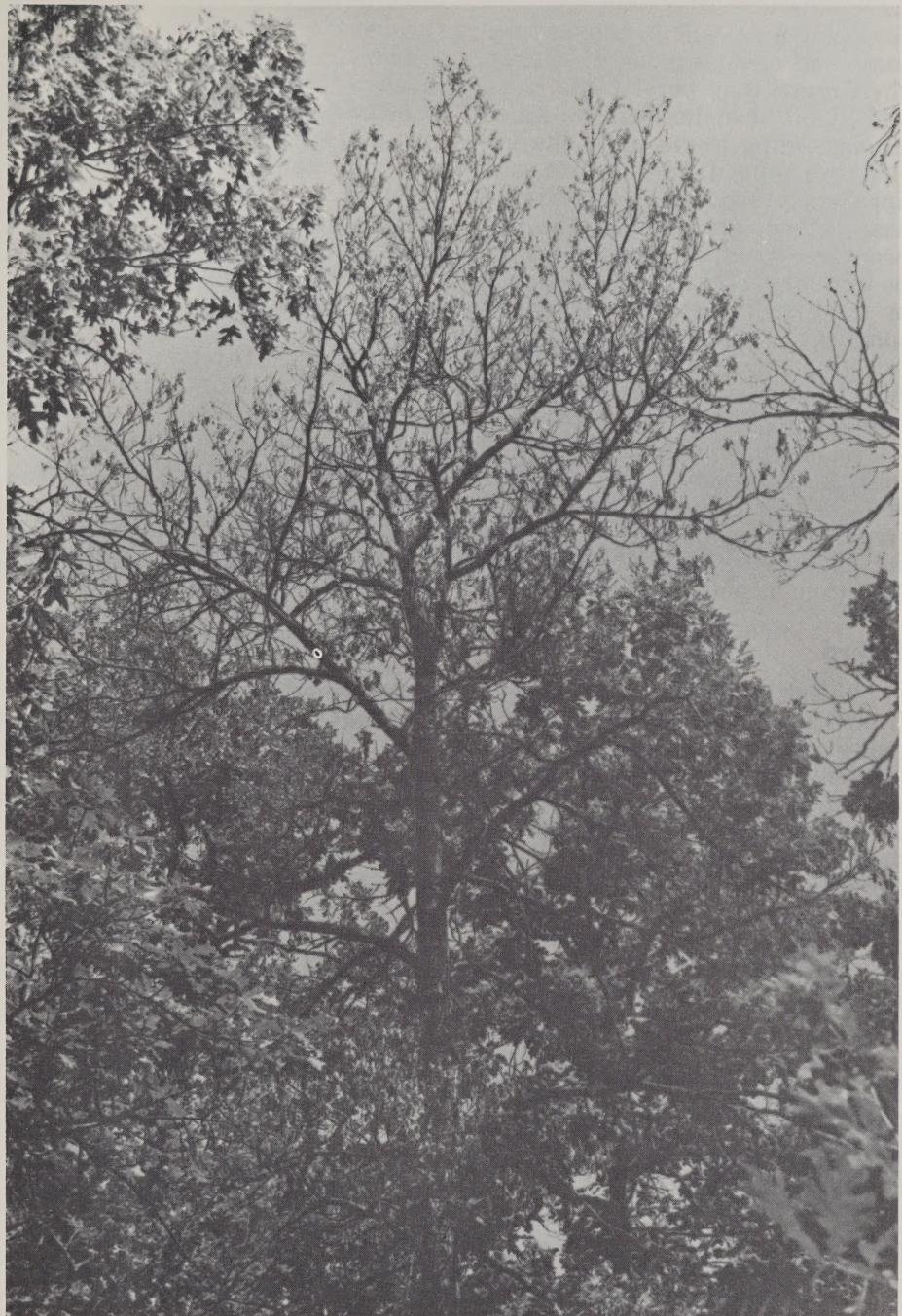
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Figure 2.—Pattern of discoloration in leaves of wilt-infected oak.

coloration and leaf curling, are very reliable diagnostic symptoms of oak wilt infection in red or black oaks; but positive diagnosis, especially in white oaks, requires isolation and identifica-

tion of the causal fungus from the suspect tree.

Oak wilt occurs less frequently in trees of the white oak group, and symptoms in this group are much more variable. The pattern



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Figure 3.—Tree dying of oak wilt. Severe defoliation accompanies the development of foliar symptoms.

of symptom progression in some white oaks, particularly bur oak, may be essentially the same as that in the red or black oaks; and the infected tree will die within one growing season. But in most

infected white oak, only one or a few branches will display symptoms and die in a year. However, the fungus may persist and if so, additional branches will be killed in succeeding years until the entire tree is dead. Some white oaks apparently recover from the disease after losing only a few branches. Leaf discoloration may be similar to that in the red oaks or may be limited to only a few completely yellowed leaves. Leaf fall does occur but may be inconspicuous when the leaves on only a few branches are involved.

The obscure and variable symptoms in white oaks create a problem in surveying for diseased trees. Only the most intensive surveillance methods will detect infection in many white oaks.

Spread

The oak wilt fungus will spread from tree to tree through natural root grafts that occur among oaks growing close together. Root grafting is known to be common in the relatively pure stands and light soils of the Lake States but is believed to occur much less frequently in other areas affected by the disease.

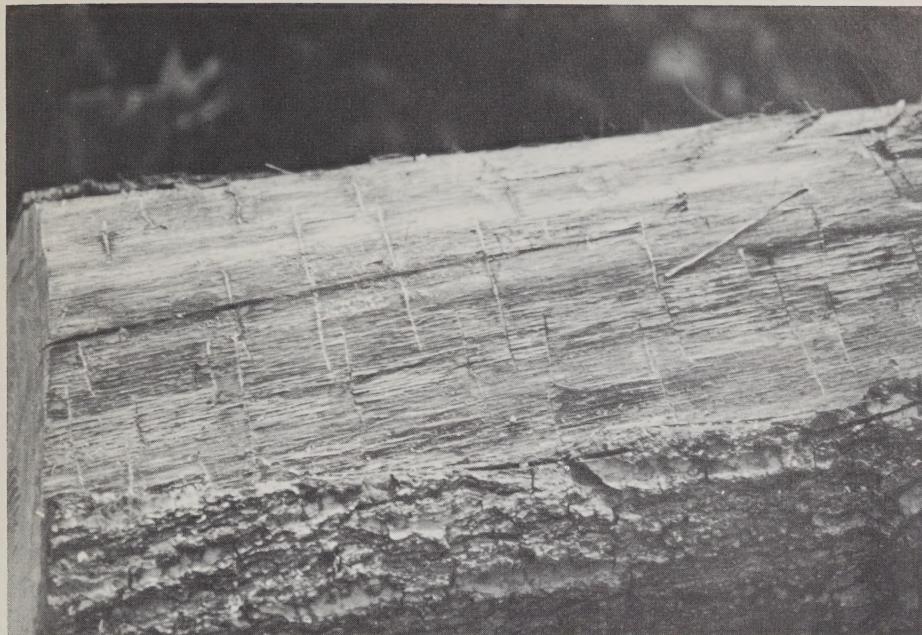
The fungus is spread over distances of more than a mile by at least two groups of insects. Fungus mats are formed under the bark in some wilt-killed trees (fig. 4). As the mats enlarge, they crack the bark, emitting odors that attract the insects, including sap-feeding beetles of the family Nitidulidae. These beetles also feed on sap from fresh wounds on healthy trees. As these insects move from diseased to healthy oaks, fungus spores adhere to their bodies and can be transmitted, causing new infections.

Another group of insects, the oak bark beetles, *Pseudopityophthorus* sp., also spreads the fungus. They breed abundantly in wilt-infected trees (fig. 5) and after egg-laying, the parent adults emerge and feed on healthy oaks (fig. 6). Larvae hatch from the eggs, develop into adults, and emerge from the diseased tree. They, too, feed on healthy oaks. Some of the parent adults and their progeny are contaminated with the wilt fungus,



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Figure 4.—An oak wilt fungus mat formed under the bark of a killed tree. The bulbous growths are pressure pads that lift and crack the bark, and the white spots are masses of spores extruded from the fruiting bodies of the fungus.



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Figure 5.—Breeding galleries of the oak bark beetle in a wilt-killed tree.

and they infect healthy trees as they feed. Bark beetles that overwinter in diseased trees carry the fungus to healthy trees when they emerge the following spring.

A number of other insects, collected from diseased trees, have been found to be contaminated with the fungus; but their role in natural spread of the pathogen has not been demonstrated.

Damage

Oak wilt has caused considerable damage in many oak woodlots and forest stands in Wisconsin, Minnesota, and Iowa. In some areas consisting of a few to 100 acres, more than half of the oaks have been killed by wilt. An appraisal of oak wilt damage in eight Wisconsin counties revealed that about 11 percent of the annual growth increase of oak forests in that area is offset by mortality from this disease.

In other States, the fungus kills thousands of trees annually;

but this loss is still only a small fraction of the tremendous volume of oak timber. Overall, the disease is not now responsible for serious economic impact.

The real importance of oak wilt lies in the fact that it is a tree killer, that it attacks our most valuable hardwood species, and that it could gradually build up to epidemic proportions over much of our oak timberland.

Suppression

Several states are actively engaged in programs to suppress oak wilt disease. Though suppression methods vary, all are designed to prevent spread through root grafts, to reduce the hazard of overland spread from wilt-infected trees, or both.

Three treatments are now being used:

(1) Diseased trees and all healthy oaks of the same species group within 50 feet of infected trees are cut, and their stumps



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Figure 6.—Oak bark beetle feeding in healthy oak twig.

are poisoned. Used in Pennsylvania, this treatment has reduced fungus spread around existing infection centers by more than 90 percent. However, this excellent level of suppression has been accomplished at a high cost in healthy trees destroyed in application of the treatment.

(2) A girdling cut is made into the heartwood of all infected trees, and the bark is removed from girdle to ground line to favor rapid drying of the tree and to prevent fungus mat formation. In West Virginia, this treatment has reduced fungus spread around existing infection centers by 79 percent in the southern part of the State but is much less effec-

tive against this type of spread in the northern part of the State.

Long-distance spread, resulting in new infection centers, is apparently suppressed by both treatments, but studies to determine the degree of suppression are not yet completed.

(3) Diseased and healthy oaks of the same species group within 50 feet of infected trees are girdled to the heartwood and are poisoned with an herbicide applied in a frill chopped near the base of the trees.

Spread of the fungus through root grafts is particularly prevalent in the deep sand soils of central Wisconsin but has been effectively controlled there by applications of methyl bromide or Vapam to the soil around diseased trees.

Note. If you suspect that the oak wilt fungus has infected your timber stand or woodlot, contact your county agricultural agent, State agricultural experiment station, or local forester or plant pathologist for control measures.

Pesticide Precautions

This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

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